PATENT SPECIFICATION

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COMPLETE SPECIFICATION

A method of Producing Printed Circuit Master Drawings

We, STANDARD TELEPHONES AND CABLES LIMITED, a British Company, of Connaught House, 63, Aldwych, London, W.C.2., England, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to a method of producing printed circuit master drawings.

The first step in the production of printed circuits from copper-clad laminated insulating boards is the preparation of a master circuit pattern drawing either to actual size or several times actual size.

Essential requirements of such master drawings are close dimensional tolerances, clear definition of line edges, and good contrast for photographic purposes.

According to the invention there is provided a method of producing a printed circuit master drawing from scraper board consisting of a base board covered with a white layer which is in turn covered with a black layer comprising removal of portions of the black layer corresponding to a required circuit or its complement.

An embodiment of the invention will now be described with reference to the accompanying drawings, in which:—

Fig. 1 is a master drawing of a circuit pattern in a "negative" form.

Fig. 2 is a master drawing of the circuit pattern of Fig. 1, but in "positive" form.

Fig. 3 is a master drawing of a circuit pattern in a "positive" form.

Referring to Fig. 1, the circuit pattern of the printed circuit master drawing is engraved on "scraper board", which consists of a soft pulp-board backing on which is coated a layer of pure while china clay and chalk to a thickness of 0.020"—0.040", which is in turn over-coated with a very thin layer of black ink. Corresponding to the desired conductor pattern, the black surface 1 is scraped away to expose the white clay as at 2, the pattern being represented by white lines on a black ground, in a "negative" form.

The contrast between the white clay base and the black surface makes the pattern exceptionally suitable for process photography. Due to the fine granular structure of the white clay base, lines with clear cut edges are possible using gauged engraving tools to scrape away the black surface. The use of gauged tools allows very close dimensional tolerances, and makes possible the drawing of the full width of a conductor line in one operation. This is particularly useful when the master drawing is prepared several times actual size, when a conductor width may be substantial.

If a printed circuit corresponding to the circuit pattern shown in Fig. 1 is to be produced by photo-engraving, the next step comprises the production to actual size of a reverse pattern photographic transparency from the master drawing which may be prepared actual size or several times actual size. An original pattern photographic transparency is obtained from this reverse pattern transparency and which has the conductor pattern shown as transparent lines between opaque areas. This original pattern transparency is used to make a contact print on a copper-clad laminate coated with a photographic emulsion. The transparency is placed in contact with the coated surface and exposed to light. After the exposure, the laminate is immersed in a suitable photographic developer which dissolves the unexposed unprinted portion of the emulsion. This leaves the light-hardened emulsion as an acid resistant pattern conforming to the desired circuit pattern. The laminate is then placed in an etching solution which removes all the copper that is not protected by the acid-resistant emulsion.

If the screen printing method is used, a reverse pattern photographic transparency of the master drawing is produced as before. This transparency is used to produce a sten-

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cil which is placed on to a silk or metal screen. The screen and stencil are placed on a copper-clad laminate and an acid-resistant liquid is spread over the stencil. The liquid is forced through the stencil and deposited on the surface of the laminate in a pattern corresponding to the required circuit pattern. The laminate is then etched as already described.

A master circuit pattern drawing may be prepared on scraper board in a positive form, as shown in Fig. 2, in which case the black surface is scraped away to leave the circuit pattern as black lines such as 3 on a white ground 4. Production by the photo-engraving method of a printed circuit from this master drawing requires only a reverse pattern photographic transparency which is used to contact-print the laminate as already described. The screen-printing method requires a reverse pattern transparency from which is obtained an original pattern photographic transparency. This transparency is used to produce a stencil as already described.

Printed circuits obtained from master drawings shown in either Fig. 1 or Fig. 2 involve a technique in which a comparatively large area of copper is etched away. This technique may be referred to as a "normal" system. Another technique which may be referred to as a "minimum etch" system is one whereby thin lines of copper are etched away to provide insulation by separation between comparatively large areas of copper. This is shown in Fig. 3, which is a master drawing on scraper board in a "positive" form, in which the clay base is exposed as at 5 corresponding to the separation required. The advantage of this technique is in the small area of copper which has to be etched off the laminate, but the technique can only be used in circuit arrangements where the electrical characteristics permit of large and indiscriminate additional capacities.

For the photo-engraving method according to this "minimum-etch" technique, only a reverse pattern transparency is required for the contact printing of the copper-clad laminate subsequent steps being as already described. For the screen printing method an original pattern photograhic transparency must be obtained from the reverse pattern transparency. This original pattern transparency is used to produce a stencil as already described.

What we claim is:—

1. A method of producing a printed circuit master drawing from scraper board consisting of a base board covered with a white layer which is in turn covered with a black layer comprising removal of portions of the black layer corresponding to a required circuit or its complement.

2. A method as claimed in Claim 1, in which said removal is effected by gauged engraving tools.

3. A method of producing a printed circuit master drawing substantially as described with reference to Fig. 1, 2 or 3 of the accompanying drawings.

4. A printed circuit master drawing produced by a method as claimed in any preceding claim.

5. A method of producing a printed circuit comprising the steps of producing a master drawing from scraper board in the manner claimed in Claim 1, 2 or 3 and showing the required conductor pattern in negative form, according to a "normal" system, obtaining a reverse pattern photographic transparency from said master drawing, producing an original pattern photographic transparency from said reverse pattern transparency, using said original pattern transparency to contact print the required conductor pattern on a copper-clad laminate in the form of an acid-resistant pattern, and etching away the copper from said laminate not protected by said acid-resistant pattern.

6. A method of producing a printed circuit comprising the steps of producing a master drawing from scraper board in the manner claimed in Claim 1, 2 or 3, showing the required conductor pattern in negative form, according to a "normal" system, obtaining a reverse pattern photographic transparency from said master drawing, using said reverse pattern transparency to produce an original pattern stencil which is placed on to a silk or metal screen superimposed on a copper-clad laminate, forcing an acid-resistant liquid through said stencil to be deposited on the surface of said laminate in a pattern corresponding to the required conductor pattern, and etching away the copper from said laminate not protected by said acid-resistant pattern.

7. A method of producing a printed circuit comprising the steps of producing a master drawing from scraper board in the manner claimed in Claim 1, 2 or 3, obtaining a reverse pattern photographic transparency from said master drawing, using said reverse pattern transparency to contact print the required conductor pattern on a copper-clad laminate in the form of an acid-resistant pattern, and etching away the copper from said laminate not protected by said acid-resistant pattern.

8. A method as claimed in Claim 7 in which the master drawing shows the required conductor pattern in positive form and according to a "normal" system.

9. A method as claimed in Claim 7 in which the master drawing shows the required conductor pattern in positive form and according to a "minimum-etch" system.

10. A method of producing a printed circuit comprising the steps of producing a

master drawing from scraper board in the manner claimed in Claim 1, 2 or 3, obtaining a reverse pattern photographic transparency from said master drawing, producing an original pattern photographic transparency from said reverse pattern transparency, using said original pattern transparency to produce a reverse pattern stencil which is placed on to a silk or metal screen superimposed on a copper-clad laminate, forcing an acid-resistant liquid through said stencil to be deposited on the surface of said laminate in a pattern corresponding to the required conductor pattern, and etching away the copper from said laminate not protected by said acid-resistant pattern.

11. A method as claimed in Claim 10 in which the master drawing shows the required conductor pattern in positive form and according to a "normal" system.

12. A method as claimed in Claim 10 in which the master drawing shows the required conductor pattern in positive form and according to a "minimum-etch" system.

Dated this 28th day of February A.D. 1956.

U. JOHN PRIOR.
Chartered Patent Agent,
For the Applicants.

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1 SHEET

COMPLETE SPECIFICATION

This drawing is a reproduction of the Original on a reduced scale

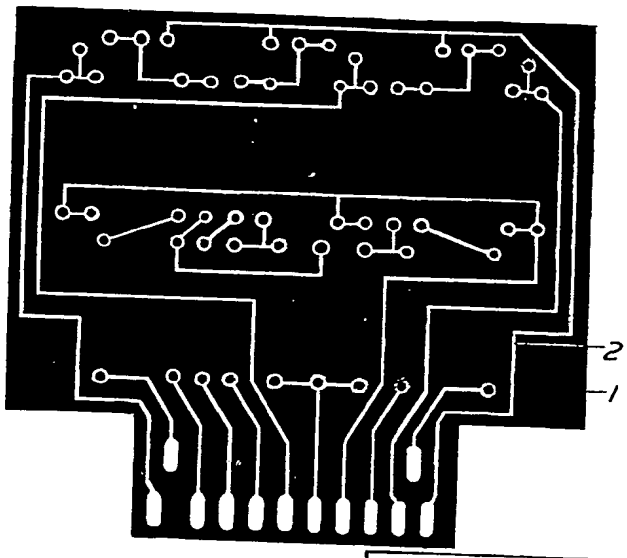

FIG. 1.

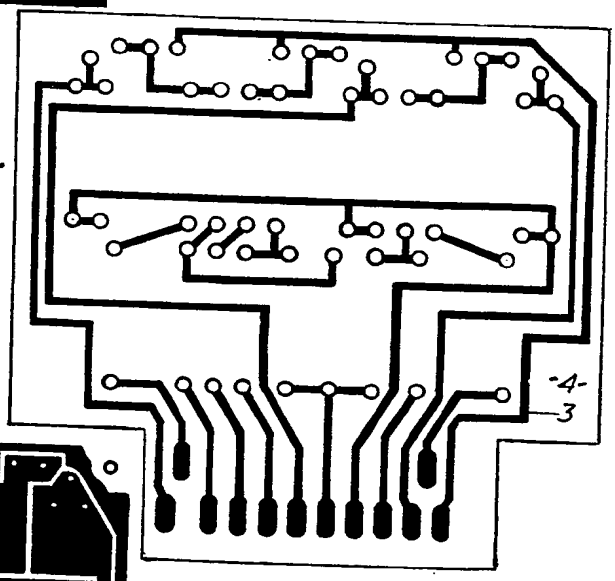

FIG. 2.

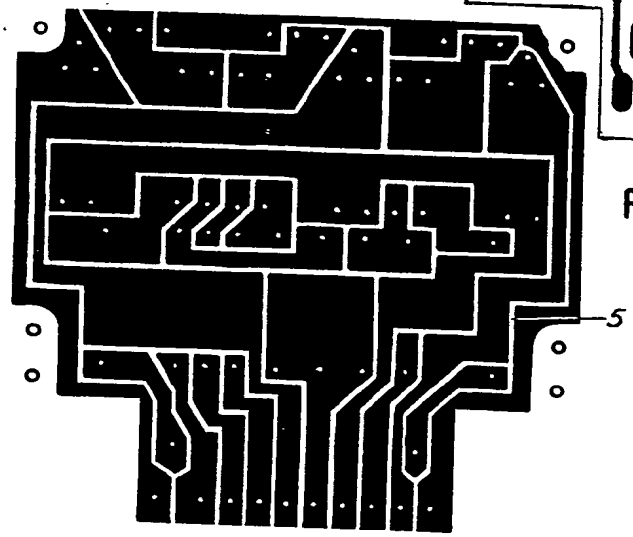

FIG. 3.